#### Worksheet 07

## 1 Vectors To Describe Objects in Space

Exercise 1. Describe the line, L, given by

$$y = 3x$$

using vectors, by choosing  $\vec{v}$  and  $\vec{w}$  so that the linear combination

$$\vec{v} + t\vec{u}$$

describes all of the points on L if we let t vary across all real numbers.

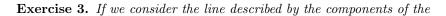
Exercise 2. Describe the line, L, given by

$$y = 3x + 4$$

using vectors, by choosing  $\vec{v}$  and  $\vec{w}$  so that the linear combination

$$\vec{v} + t\vec{w}$$

describes all of the points on L if we let t vary across all real numbers.



$$<1,3>+t<-1,5>$$

as we let t vary across all real numbers. Describe this line using parametric equations, then describe it using slope-intercept form.

Exercise 4. If we consider the line described by the components of the

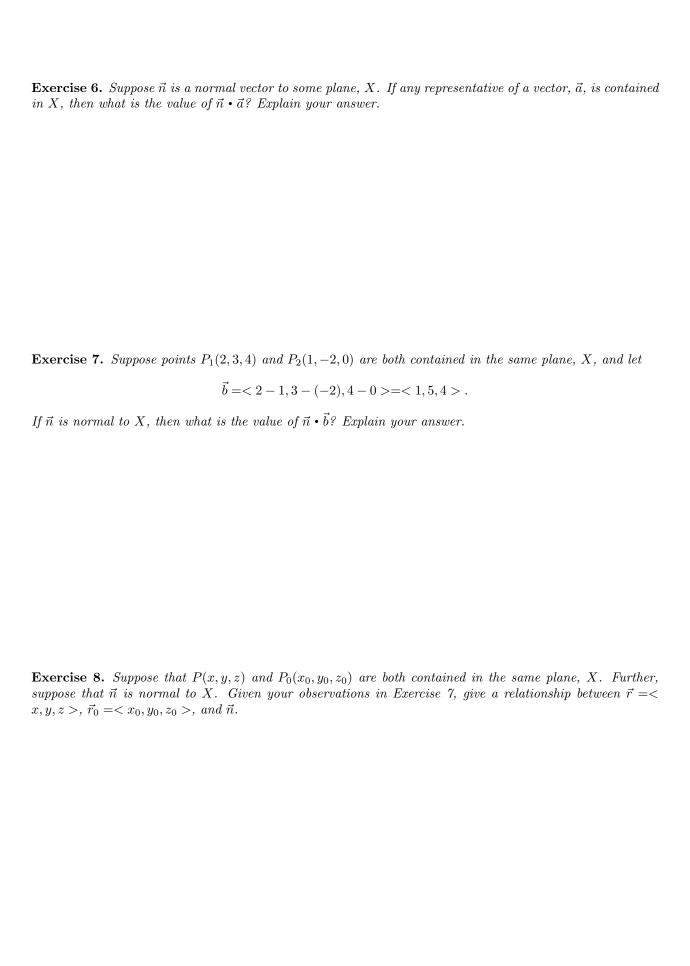
$$<1, -2, 3>+t<-1, 5, 1>$$

as we let t vary across all real numbers. Describe this line using parametric equations.

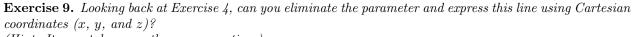
### Exercise 5. Given the points

$$P_1(1, 2, -1)$$
  
 $P_2(2, -1, 0)$   
 $P_3(0, 5, 0)$ 

Find a vector normal to the plane containing  $P_1$ ,  $P_2$ , and  $P_3$ .



## 2 Generalizing and Application

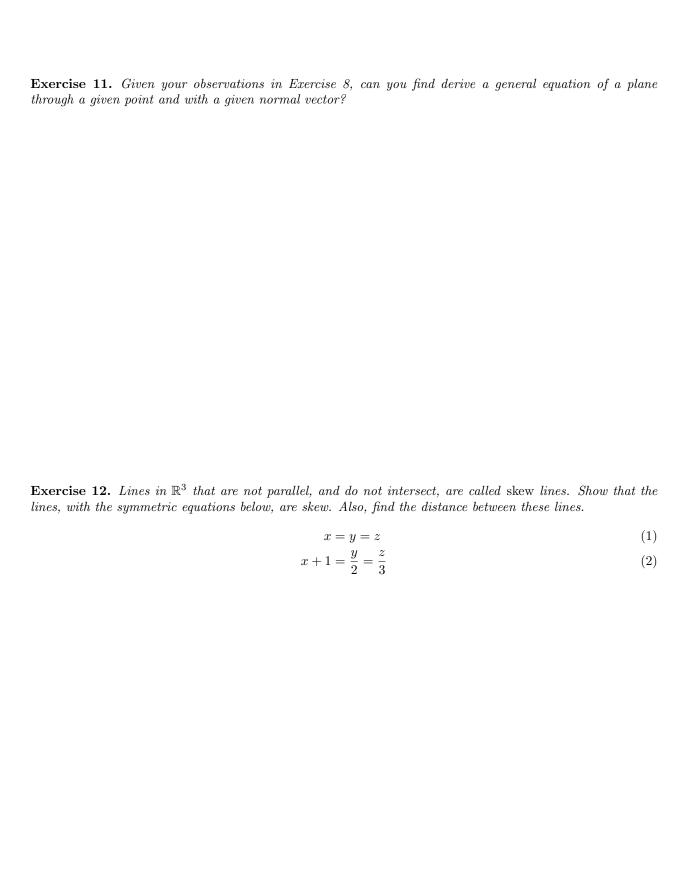


(Hint: It may take more than one equation.)

Exercise 10. In general, can you express the line described by

$$< x_1, y_1, z_1 > +t < x_2, y_2, z_2 >$$

as we let t vary across all real numbers, using Cartesian coordinates? When might you encounter problems? Can every line in  $\mathbb{R}^3$  be expressed as a linear combination of vectors, as in (1)? Can every line in  $\mathbb{R}^3$  also be expressed in Cartesian coordinates?



# 3 Challenge

**Exercise 13.** Given a plane, X, and a point, P, find an equation that describes the distance from P to X.